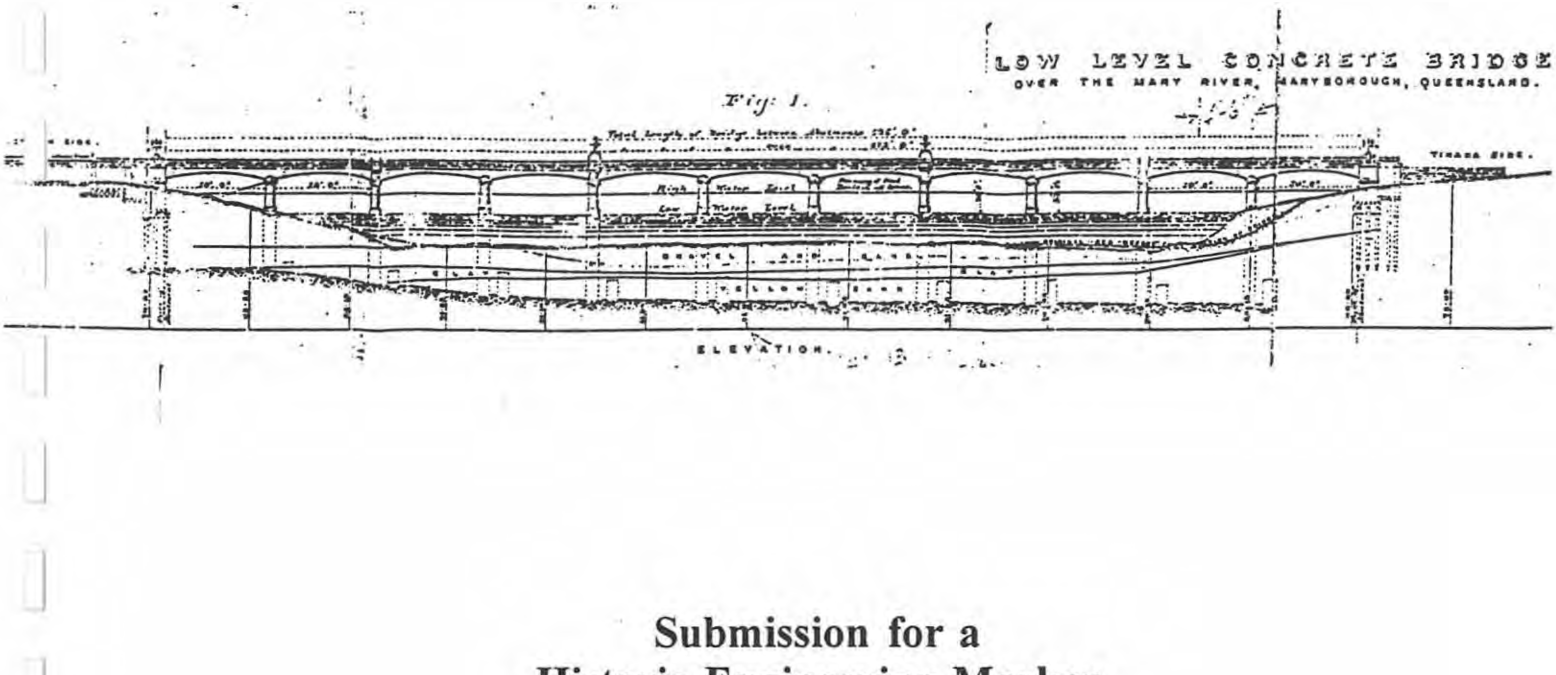
THE INSTITUTION OF ENGINEERS, AUSTRALIA

NATIONAL COMMITTEE ON ENGINEERING HERITAGE

PLAQUING PROGRAM

LAMINGTON BRIDGE, MARYBOROUGH, QUEENSLAND



**Submission for a
Historic Engineering Marker
from
The Engineering Panel
Queensland Division
Institution of Engineers, Australia
1996**

The Institution of Engineers, Australia
Queensland Division

HERITAGE PANEL

PLAQUING OF LAMINGTON BRIDGE, MARYBOROUGH
(Historic Engineering Marker)

CONTENTS

Commemorative Plaque Nomination Form

Date: 22 May 1996

To:

Commemorative Plaque Sub-Committee
The Institution of Engineers, Australia
11 National Circuit
BARTON ACT 2600

From:

Heritage Panel
General Branch
Queensland Division

The following work is nominated for an Historic Engineering Marker award:

Name of work: LAMINGTON BRIDGE, MARYBOROUGH, QUEENSLAND

Location: 2 km south of Maryborough on the Maryborough-Hervey Bay Road

Owner: Queensland Department of Main Roads

In support of the nomination the following information is provided:

- Proposal outlining the history, design, significance of the bridge together with the proposed wording for the commemorative plaque.
- Plans of the original and widened bridges.
- Locality plan
- Correspondence outlining the owner's, Department of Main Roads, approval of the plaquing of the bridge, agreement to be joint participants in the plaquing project and the Department's contribution to the celebrations.
- Correspondence from the Historical Society re incorporation of the plaquing ceremony in the Centenary celebrations.

The nominating body, in anticipation of this nomination being approved, has commenced discussions with the Maryborough Wide Bay and Burnett Inc Historical Society concerning a suitable presentation/unveiling ceremony.

....
Chairman of Nominating Panel

....
Secretary of Nominating Panel

The Institution of Engineers, Australia
Queensland Division

HERITAGE PANEL

LAMINGTON BRIDGE, MARYBOROUGH PLAQUING PROPOSAL
(Historic Engineering Marker)

1.0 Introduction

The abnormal floods of February 1893 caused the partial destruction of the high-level timber bridge across the Mary River, Maryborough thus cutting off the means of communication between Maryborough and Tinana and the important goldfield of Gympie. The Queensland Government and the Maryborough Bridge Board then decided to replace this bridge, erected in 1874, with a low-level bridge. The new bridge, a concrete structure, was opened to traffic in October 1896 and is still in service.

2.0 Background

2.1 *Location*

The Lamington Bridge spans the Mary River on the southern approach to Maryborough being only 2 kms from the city centre. Maryborough is 260 kms by road north of Brisbane. Prior to the opening of the Maryborough Bypass on 14 September 1990 this bridge was an important link on the Bruce Highway between Brisbane and Cairns.

2.2 *The Name*

'The bridge was formally opened for traffic with some ceremony on the 30th October, 1896, by the Hon. David Hay Dalrymple, M.L.A., Minister for Public Works, in the presence of a large and representative assembly of the public, and the structure was named the Lamington bridge, in honour of His Excellency the Right Hon. Baron Lamington, K.C.M.G., Governor of Queensland.'

3.0 History

From January 1864 until the opening of the Maryborough Bridge on January 1 1876, crossing of the Mary River was by a ferry service established by John St Ledger. The ferry was known as the Princess Ferry and during the gold rush carried as many as 500 people across the river daily.

This bridge, a timber structure, linked Maryborough with Gympie where the gold rush was in full swing, and provided Tinana and districts south with better communication and transport service with the township. The floods of February 1893 resulted in its partial destruction and it was considered that a low-level bridge would serve all purposes and would be much safer during floods as 'It had been amply demonstrated during floods in various parts of the colony that floating logs, trees, and heavy masses of debris are not usually carried downstream in any considerable quantity until bridges built at low levels have become entirely submerged, and then all drift timber can float harmlessly over them.'

A further consideration for the construction of a low-level bridge was the corresponding saving in the cost of maintaining the roadway and the bridge generally. A low-level bridge 613 feet in length was considered as compared to the flood damaged high-level structure 1,456 feet in length.

Some time was spent investigating the new bridge site with surveys, taking soundings and borings, and preparing and considering various schemes.

Alfred Barton Brady, M. Inst. C.E. 'was induced to recommend a concrete bridge, as it ensures a structure of very great strength, almost everlasting in character, and the annual expenditure in maintenance is consequently reduced to a minimum.' Brady's design for a concrete bridge was finally approved by the Maryborough Bridge Board and the Government. tenders were invited and a contract was let in September,1894.

'The total cost of the bridge and approaches, including engineering and supervision, amounted to 25,000 pounds. The first contractor having failed financially in May, 1895, before much work was done, a second contract for the construction of the bridge had to be let; the successful contractors were Messrs. McArdle and Thompson of Brisbane, who signed their contract on 26th July 1895, the time allowed for the completion of the work being 15 months. The contractors completed their work within contract time in a highly creditable manner; the bridge being novel in character, and the river subject to frequent floods, the work was not carried through without some difficulties, which, however, were successfully overcome.'

4. <u>Design</u>

The dimensions of the bridge are:- total length, 613 feet; waterway between faces of abutments, 595 feet; width of roadway between kerbs, 20 feet 8 inches; width between faces of arches 22 feet 8 inches.

The deck level of the bridge is 12 feet 6 inches above high water of ordinary spring tides, when the depth of water at the bridge is 28 feet. As a comparison the maximum flood level of February, 1893 is 33 feet above high water.

Between abutments the bridge has eleven, 50 foot clear, concrete arch spans with an end span of 25 feet at each approach.

The abutments are constructed of Portland cement concrete, consisting of 5 parts hard stone of 2 inch gauge, 2 parts clean sharp sand, and 1 part Portland cement supported by ironbark piles driven to solid foundation.
The piers are constructed as two rectangular columns below water level, arched over between low and high water level and then carried up solid to the springing of the arches. All piers were sunk to a rock foundation by means of wrought-iron caissons, the maximum depth below high water being 55 feet 8 inches. De-watering of foundations was carried out with a canvas baler 2 feet 4 inches in diameter, 4 feet in depth, with 1 & 3/4-inch round iron hoops at the top and bottom and covered with leather to prevent chafing. This baler was able to discharge an average 3,000 gallons or about 35 lifts per hour.

The superstructure concrete consists of 4 parts hard stone of 2-inch gauge, 1 & 1/2 parts clean sharp sand, and 1 part Portland cement. The arches are strengthened by means of a continuous framework of steel railway rails, weighing 41 & 1/4 lbs per linear yard and spaced 2 feet apart in the arching.

'The mixed concrete was conveyed from the platform to the packers in side-delivery tip-wagons running on a temporary tram-road, from which it was discharged onto concrete boards and shovelled therefrom into the work, being well cut in with spades, and rammed solid, a special form of rammer being provided for packing under the bottom rails of the skeleton framing.'
The average number of men employed in forming the arches was:- seventeen labourers filling gauges and mixing concrete, six labourers filling trucks and running them to four packers and rammers, four labourers loading stone and sand, six horses and drays with drivers, and one carpenter. In all, forty men who mixed and laid an average 11 cubic yards of concrete per hour.

The original roadway of the bridge was formed of iron-bark block paving, 5 inches deep, which were coated with boiling tar prior to being placed. Joints were completely filled and made watertight with a mixture of boiling coal tar and clean sharp grit or river sand. However, a flood in January 1898 washed off about two-thirds of the wood blocks and the entire wood paving, together with road approaches totalling 1,071 feet, was then replaced with tarred metalling to an average depth of 6 inches.

Lighting of the bridge was provided by gas-lamps on the upstream side of the bridge. The end lamps had three lanterns on cast-iron standards with the intermediate lamps having one lantern each on angle bar standards. The lamps were fixed with special connections for ease of removal during flood times.

5.0 Widening

In 1970 the bridge was widened to 28 feet between kerbs at an estimated cost of $106,821. The widened structure made provision for walkways together with water and telephone services. Main Roads Department Plan No 98261 is attached.

6.0 Historical Significance

Queensland is notable for its early use of concrete in bridge construction, both in rail and road bridges, and the successful completion of this structure, the first of its kind in Australia, can be attributed to the engineering skills and resources of the bridge design engineer Mr A B Brady and his resident engineer Mr A J Goldsmith.

The Lamington bridge is significant among world bridges, both because of its construction date and also for the size of the structure. It is effectively a continuous girder bridge, with eleven main spans and two end spans. Brady thought of this bridge as a flat arch, but its reinforcement and form is such that its behaviour would more likely be that of a continuous girder. The spans are haunched solid concrete girders with arched soffits, and Brady attributed the strength of the spans partly to flat-arch action but provided steel reinforcement in the tension areas in the top of the girders at mid-span.

The first concrete arch bridge in the world dates from about 1890, and conventional reinforced concrete did not come into use until about 1900.
This bridge is listed on the Heritage Register under the provisions of the Queensland Heritage Act 1992.

7.0 Proposed Plaque Wording

HISTORIC ENGINEERING
MARKER

LAMINGTON BRIDGE

OPENED TO TRAFFIC ON 30 OCTOBER 1896, THIS IS AUSTRALIA'S FIRST LARGE REINFORCED CONCRETE ROAD BRIDGE. DESIGNED BY A. B. BRADY, AND NAMED AFTER THE GOVERNOR OF QUEENSLAND, IT HAS ELEVEN 15.2M SPANS AND A TOTAL LENGTH OF 187M, LARGER THAN ANY KNOWN COMPARABLE BRIDGE IN THE WORLD AT THAT TIME. BRADY WAS HONOURED BY THE INSTITUTION OF CIVIL ENGINEERS, LONDON FOR ITS DESIGN. THE BRIDGE WAS WIDENED IN 1970.

DEDICATED BY
THE INSTITUTION OF ENGINEERS, AUSTRALIA AND
THE DEPARTMENT OF MAIN ROADS, QUEENSLAND, 1996.

8.0 Location of Plaque

It is proposed that the plaque be fixed to a concrete monolith adjacent to the existing one supporting the plaque commemorating the opening of the bridge in 1896.

The new monolith, of similar shape but smaller dimension than the existing one, will be located on the north-eastern approach to the bridge with ease of access by the public via a parkland setting.

9.0 Date of Ceremony

The plaquing ceremony will be part of the Maryborough Wide Bay and Burnett Historical Society Inc. centenary celebrations planned for 26 October 1996 with the unveiling of the plaque timed for 4pm. The bridge will be closed to traffic between 2pm and 5pm.

10.0 References

Brady, A.B. Low-Level Concrete Bridge over the Mary River, Maryborough, Queensland (Paper No. 3184)
The Institution of Civil Engineers Minutes of Proceedings Vol. 141, 1899-1900, pp 246-257.

O'Connor C. 1983 Early Queensland Road Bridges in Main Roads Department publication Queensland Roads, December 1983.

SECT. II.—OTHER SELECTED PAPERS.

(*Paper No. 3184.*)

"Low-Level Concrete Bridge over the Mary River, Maryborough, Queensland."

By ALFRED BARTON BRADY, M. Inst. C.E.

THE old high-level timber bridge, 1,456 feet in length, erected across the Mary River, Maryborough, in 1874, having been partially destroyed by the abnormal floods which occurred in February, 1893, thus cutting off the means of communication by road between Maryborough and Tinana and the important goldfield of Gympie, it was decided by the Queensland Government and the Maryborough Bridge Board to construct a low-level bridge of a permanent character on the downstream side of the old structure, and to take down, and remove from the site, the standing portion of the old timber bridge, the traffic meanwhile being provided for by a steam ferry.

A low-level bridge, it was considered, would serve all purposes and would be much safer during floods. It had been amply demonstrated during floods in various parts of the colony that floating logs, trees, and heavy masses of débris are not usually carried downstream in any considerable quantity until bridges built at low levels have become entirely submerged, and then all drift timber can float harmlessly over them. A low-level bridge would also necessarily be so much shorter between the banks—in this instance 843 feet shorter—and the cost of maintaining the roadway and the bridge generally would be correspondingly reduced.

After some time spent in making surveys, taking soundings and borings, and preparing and considering various schemes, the Author's design for a concrete bridge was finally approved by the Bridge Board and the Government; tenders were invited and a contract was let in September, 1894. The Author was induced to recommend a concrete bridge, as it ensures a structure of very great strength, almost everlasting in character, and the annual expenditure in maintenance is consequently reduced to a minimum.

New Bridge.—The dimensions of the new bridge, Fig. 1,

Plate 1, are:—total length, 613 feet; waterway between faces of abutments, 595 feet; width of roadway between curbs, 20 feet 8 inches; width between faces of arches, 22 feet 8 inches. The level of the roadway on the bridge is 12 feet 6 inches above high water of ordinary spring-tides, when the depth of water at the bridge is 28 feet; the maximum flood-level, namely, that attained in February, 1893, is 33 feet above high water. There are eleven concrete spans, or arches, each 50 feet in the clear, carried upon ten concrete piers in the river and two abutments, Fig. 1, Plate 1. The rise of each arch is 4 feet, or $\frac{2}{25}$ of the span; the thickness of concrete at the crown of each arch is 20 inches at the centre of the roadway and 18 inches at the curbs, the thickness at the haunches along the centre line being 5 feet 8 inches, Figs. 3 and 4, Plate 1.

Abutments.—The abutments, Figs. 2, Plate 1, are constructed of Portland cement concrete, composed of 5 parts of hard stone broken to a 2-inch gauge, 2 parts of clean sharp sand, and 1 part of Portland cement, and are carried upon ironbark piles shod with 28-lb. wrought-iron shoes driven to a solid foundation, those in the Maryborough abutment to an average depth of $26\frac{1}{2}$ feet, and those in the Tinana abutment to an average depth of 29 feet below low-water level, the piles being spaced 4 feet 6 inches apart, centre to centre.

Piers.—Each of the piers is constructed in two rectangular sections or columns below low-water level, arched over between low and high water and then carried up solid to the springing of the arches, Figs. 3 and 4, Plate 1. Each section of the pier foundations is 10 feet 4 inches by 5 feet 6 inches in horizontal cross-section, and all were sunk to a rock foundation, the maximum depth below high water being 55 feet 8 inches. The piers have semicircular ends above low water and are battered above the plinth at the rate of 1 in 24, the sides or faces of each pier being battered at the rate of 1 in 48, to a thickness at the impost, or string-course level, of 4 feet 6 inches, Figs. 3 and 4, Plate 1. The sections or columns, twenty in number, were sunk by means of wrought-iron caissons. The cutting lengths, 7 feet long, were formed of external bottom plates, $\frac{1}{2}$ inch thick by 3 feet wide, and top plates $\frac{3}{8}$ inch thick by 4 feet wide, with an internal pocket formed of $\frac{1}{4}$-inch plates, 3 feet 3 inches wide, having 2 inches by 2 inches by $\frac{1}{4}$-inch angles at the top, Figs. 5, Plate 4. The angle-bars at the joints of the cutting lengths were $2\frac{1}{2}$ inches by $2\frac{1}{2}$ inches by $\frac{3}{8}$ inch, and acted also as stiffeners. The cutting edge was also stiffened with a flat bar, 8 inches by $\frac{5}{8}$ inch, double riveted. The

intermediate caissons, each 4 feet in length, were formed of ¼-inch plate, jointed, stiffened and stayed with 2 inches by 2 inches by ¼-inch angle-bars throughout, Figs. 6, Plate 1, and were left in place on completion of the work below low-water level. The caissons were designed to be of the least expensive construction possible, all smith-work or forging of angles being avoided, except in the cutting lengths, where the corners were welded. In all other lengths of the caissons, the angles were cut off square, the corners being formed with stiffening pieces of 2 inches by ½-inch flat iron, and the joints were made up with pine-wood filling. Although this plan was adopted to cheapen the cost of manufacture, it is questionable whether the extra cost of making a superior joint at the corners of the caissons by bending the angle-bars would not have been more satisfactory in the end, as the slight amount of leakage encountered in sinking the piers, at no time exceeding 300 gallons per hour, which evidently came through at the corners, might have been entirely avoided. The slight countersink left in punching the plates was found to be sufficient to hold the plates together, the rivets being simply "nobbled," and the work was practically flush-riveted on the outside, without the necessity for any countersinking of the holes in the plates.

The method adopted in sinking the piers was as follows:—A temporary staging of piling, securely braced, was prepared on the site of each pier, Figs. 9, Plate 1; the bottom or cutting length of each caisson was slung to four wrought-iron rods, 2 inches in diameter, screwed ⅜-inch pitch for 10 feet of their length, and operated by nuts with cross bars having arms of 3 feet 9 inches in length, and provided with anti-friction rings underneath. Cement concrete, gauged 5, 2 and 1, was then carefully packed into the pockets and brought up to the top of the caissons, the interior cavity being formed by removable panels of 1¼-inch rough pine, strutted as shown in Figs. 5, Plate 1. The first and second lengths of the intermediate caissons were then bolted on to the top of the cutting length, the joints being made with a chunam of coal-tar and quicklime, and the concrete lining was continued to the top. The caissons were then lowered by "fleeting" the screw hangers, for which purpose strong clamps (*a*), Figs. 9, Plate 1, were provided, additional caissons being fixed and the concrete lining being continued until the weight was taken on the bed of the river, when divers released the hangers by driving out the bolts securing them to the cutting edge. Sinking then proceeded in the ordinary way by dredging where practicable, but the bulk of the excavation proved to be a tenacious and compact mixture of

sand, gravel and clay, with small shells, quite unsuitable for dredging, and removable only by divers. On reaching the rock, the weight of the column, amounting to 60 tons, was again taken on the screws, the suspending rods being transferred to the inside of the column, and a length of each rod being built into the concrete for suspending the column, Figs. 9, Plate 1. The surface was then levelled to a fixed depth gauged below the cutting edge by divers, and the column was finally lowered into position upon bags of fine concrete laid carefully under the cutting edges. Into these the caissons bedded themselves, forming a tight joint to exclude leakage when filling in the concrete core within the column.

. The shaft was then sealed by the deposition of concrete through the water in self-releasing skips up to about 10 feet below the bed of the river at the pier. The concrete about the cutting edge, gauged 4, 1½ and 1, was laid by a diver and carefully packed round the bags to a depth of 4 feet. The remainder of the seal was gauged 5, 2 and 1. After allowing the core to set for 2 or 3 days, or longer if convenient, the water in the shaft was removed by a canvas baler worked from a steam winch. The baler was made of No. 1 canvas, and measured 2 feet 4 inches in diameter, and 4 feet in depth, being provided with strong hoops of 1¾-inch round iron at the top and bottom, covered with leather to prevent chafing, and discharged on an average about 3,000 gallons, or about 35 lifts, per hour. The remainder of the concrete core was then laid, carefully packed and rammed, in the dry, to a level of about 8 feet below the full height of the concrete casing, thus forming a key for the upper portion of the concrete pier, Figs. 7, Plate 1.

Some leakage had to be contended with in getting in this portion of the work; the amount, however, was not considerable, averaging between 200 gallons and 300 gallons per hour. By mixing and laying with two full gangs of men, with separate steam derricks to each gang for lowering the concrete, the core was got in with sufficient rapidity to enable the packers to keep well ahead of the leakage, and so prevent the water coming through the surface of the concrete. In one or two instances, when through mismanagement this did occur, considerable difficulty was experienced in removing the water, which accumulated without disturbing the cement. To avoid such a contingency, the resident engineer had a sump formed of ordinary drainage tiles, 10 inches by 6 inches, of horseshoe shape, laid in the corner of each shaft as the core was brought up, and into this the suction-pipe of a Goold semi-rotary pump was inserted; by this means the

level of the water was kept at any time below that at which the concrete was being laid, without disturbing the cement or interfering with the packers. This sump was carried up to the level of the plinth and was afterwards filled in solid with concrete. The top of each column, forming the plinth of the pier, was laid with 4, 1½ and 1 concrete in temporary iron caissons, similar to the intermediate lengths of the permanent caissons, but having all the angles fixed externally. These temporary caissons were carried up to above high-water mark and were supported by timber shores, Figs. 9, Plate 1. The shores were arranged to be easily knocked out and removed as the concrete reached the top of the plinth of the pier. To provide for any overturning action resulting from the flood pressure upon the face of the bridge producing a tensional stress in the upstream columns of the piers, a railway rail, Vignoles pattern, weighing 60 lbs. per yard, and 20 feet in length, with suitable cross bars attached, was built into the concrete, Fig. 4, Plate 1.

The matrix for constructing the piers above plinth level was then formed, having framed moulds for the circular ends and for the arch connecting the sections or columns, and 1¼-inch pine boards supported on studding for the intermediate flat surfaces, all properly stayed against the false works used in sinking the columns of the piers. The work of laying the concrete, gauged 5, 2, and 1, was commenced immediately the falling tide had left the surface at the plinth level. These surfaces had been previously thoroughly cleaned and picked over, and were well grouted with 1 to 1 compo, to receive the upper concrete work, the first few gauges deposited being made richer in cement to secure perfect adhesion. The packing of the concrete was carried on well in advance of the rising tide, to the height of the string course, which was subsequently laid of 4, 1½ and 1 concrete in framed moulds. The whole of the concrete in the piers was deposited in self-discharging skips, Figs. 6, Plate 1, worked from a punt on either side of the pier. The temporary wrought-iron caissons, from the river-bed up to low-water level, were by an arrangement with the contractors, left as a permanent protection to the concrete piers. The average pressure upon the foundations, making due allowance for friction and buoyancy, amounts to 4·14 tons per square foot.

Superstructure.—The concrete in the arches or superstructure of the bridge is composed of 4 parts of broken hardstone of 2-inch gauge, 1½ part clean sharp river sand, and 1 part of Portland cement. The segmental arches are strengthened by means of a

continuous framework formed of steel railway rails, Vignoles pattern, weighing 41½ lbs. per linear yard, spaced 2 feet apart in the arching, Figs. 2, 3, and 4, Plate 1. There are eleven skeleton frames in all, each consisting of two members only, viz., a horizontal top member, continuous for the entire length of the bridge, and a curved or segmental lower member, following the curvature of the arch in each span, Fig. 3, Plate 1. The frames are bolted to cast-iron chairs or bed-plates on each pier and abutment, and on the latter the chairs are well anchored down to the concrete by long bolts and plates, Figs. 8, Plate 1. There are two cross ties to the framing in each span and one over each pier, each tie being 2½ inches by 2½ inches by ⅜-inch iron angle-bar riveted to the flange of the upper member of the skeleton framing, Fig. 3, Plate 1, chiefly for the purpose of stiffening and giving lateral support to the framing during the deposition and ramming of concrete in the arches. The concrete was laid on wood centering, and the steel skeleton framing was completely embedded. The whole surface of concrete exposed to view above low-water level, including soffits of arches, was floated to form a uniform surface, with 1 part of Portland cement to 2 parts of sand laid on in two thicknesses, and finished to not less than ⅝-inch thick; the whole then received a coat of cement-wash, composed of 6 parts of cement to 1 part of sand, mixed fluid in buckets close to where it was required and used immediately afterwards.

In constructing the arches forming the superstructure of the bridge, a considerable amount of forethought had to be exercised to ensure the joints being placed in the positions least detrimental to the ultimate strength of the structure, considered in relation to the flood stresses, as well as to those resulting from the maximum superimposed load, and also to secure the deposition of the greatest quantity of concrete practicable during daylight—which was not more than 11 hours—as the contractor's arrangements did not admit of continuing work through the night. With this object in view, it was decided to lay a half width of a complete span each day, and this arrangement was adhered to, the whole superstructure being laid in 22 days, with the exception of the parapets, which were built subsequently. To assist the transverse joints between contiguous arches, two cavities, each 4 feet by 2 feet 6 inches, were left along the tops of the piers and extending the full depth of the haunches of the arch; these cavities were afterwards filled in with a richer concrete gauged 3, 1¼ and 1, forming keys which materially assisted the joint to withstand flood-stresses.

The false works for laying the arches were of pine timber throughout, and consisted of six ribs, 4 inches thick, in the width of the arch, supported on capsills carried on three piles driven into the river-bed at the centre of each span, the outer ends being carried on the staging of the piers. Each rib was 2 feet deep at the centre and 1 foot at the ends, and was formed of two flitches securely bolted together with $\frac{5}{8}$-inch bolts. The ribs were laid with $1\frac{1}{2}$-inch pine planking, wedged at the ends to the required levels, and afterwards securely strutted on to piling. The mould was then completed by the erection of the sides, of $1\frac{1}{4}$-inch boarding on studding, strutted by longitudinals from the piers to the centre capsills, Figs. 7, Plate 1. The whole of the concrete for the arches was gauged 4, $1\frac{1}{2}$ and 1; it was mixed on a large platform, laid on the abutment on the Maryborough side, the stone being carted from a heap 400 yards away and tipped direct into the gauge boxes, and the sand being wheeled from a heap close at hand.

The mixed concrete was conveyed from the platform to the packers in side-delivery tip-wagons running on a temporary tram-road, from which it was discharged on to concrete boards and shovelled therefrom into the work, being well cut in with spades, and rammed solid, a special form of rammer being provided for packing under the bottom rails of the skeleton framing. The concrete was mixed moderately wet, it being found that any excess of water drained off readily through the cleading of the mould, without carrying away cement, the water which escaped being perfectly clear and limpid, whilst the concrete laid better together and could be rammed without difficulty.

As it was thought probable that during floods an upward thrust might be brought to bear upon the arches on the upstream side by trunks of trees or logs of timber becoming jammed under them, a nest of six steel rods, each $\frac{7}{8}$-inch in diameter, was built into the concrete across the full span of each arch and parapet curb, along the upstream side of the bridge only, to resist the stresses induced by such an upward thrust, Fig. 10, Plate 1. Steel rail dowels were also used at intervals to connect the concrete parapet curbing to the arching.

The average number of men employed in forming the arches was as follows:—Seventeen labourers filling gauges and mixing concrete, six labourers filling trucks and running them to four packers and rammers; also four labourers loading stone and sand, six horses and drays with drivers, and one carpenter, or forty men

in all, who mixed and laid, on an average, 11 cubic yards of concrete per hour.

Stone.—The only ... stone in the bridge is the sandstone coping to the blockings of the parapets at each end of the bridge, the bedstones to the lamp pillars, and the porphyry margin stones to the gully gratings, Figs. 2, Plate 1.

Roadway.—The roadway on the bridge was formed of iron-bark block paving, 5 inches deep, sawn from 9-inch by 3-inch planks. The blocks were coated with boiling tar and were laid with close joints directly on the surface of the concrete superstructure, which was finished with a camber or rise of 2 inches along the centre of the roadway for drainage. The blocks were cut and stacked for seasoning six months before being laid, and after laying, the joints were completely filled and made watertight with a boiling mixture of asphaltum coal tar, and clean sharp grit or river sand. When completed, the whole surface of the wood paving received a thorough coating of well-boiled tar, and was afterwards covered with a layer of sharp sand. Four rows of blocks were laid longitudinally against the curbs on either side of the bridge, the paving between the longitudinal rows being laid transversely. A space or seam, 1½ inch wide, was left next the curbs, and was filled with mastic to allow for the expansion of the blocks in wet weather. A disastrous flood, however, which occurred in January 1898, did so much damage to the roadway, washing off about two-thirds of the wood blocking, and the whole of the metalling on the approaches, that it was decided to remove the remaining portion of the wood paving, and to lay the entire length of the bridge and its approaches, a total length of 1,071 feet, with tarred metalling, composed of two parts of hard blue metal broken to a 2-inch gauge, two parts to a 1-inch gauge, and one part of blue metal screenings or chippings to pass through a ¼-inch mesh, the whole thoroughly dried by heat and then well mixed with boiling coal-tar and stacked to allow the superfluous tar to run off, after which it was spread uniformly, to an average depth of 6 inches, well punned or rammed, brought to an even surface, and then well rolled with a 5-ton roller until thoroughly consolidated, and formed to the proper convexity.

The entire area of tarred metalling was afterwards coated uniformly with fine grit sifted from the blue metal screenings. The coal-tar was kept continually boiling for at least 3 hours before being mixed with the metal or screenings, and tarred metalling was prepared and laid down during fine weather only. This work was completed satisfactorily in November 1898. The

22.69 MCC Datum
(STATED)
22.69 MCC Datum
57.66
4.05
53.61
100.85
57.66
43.19

surface drainage from the roadway on the bridge is provided for by two gully chambers every 54 feet in the length of the bridge, formed in the concrete of each span, covered with wrought-iron surface gratings in cast-iron frames, protected with hardstone margins, and having outlet pipes, 4 inches in diameter, through the arches, discharging directly into the river, Fig. 1, Plate 1.

Parapets.—The handrailing of the bridge consists of removable wrought-iron stanchions fitted with turned ends into galvanised cast-iron sockets, set in the concrete curbs. Through the forged stanchions pass three rails formed of gas tubing, screwed together at the joints, the two upper tubes being 1¼-inch bore and the lower tube ¾-inch bore. The parapets are made in sections, four to each span, or 13 feet 6 inches in length, having three stanchions in each, for convenience of removal, and with special semicircular sections on the four intermediate escapes over the piers. It was demonstrated by the resident engineer before the opening of the bridge, that, with the aid of three men, the entire handrailing could be removed in sections, replaced and keyed up again and fixed perfectly rigid in 3 hours; thus showing that, in the case of a sudden rise in the river, no fear need be entertained for the security of the handrailing.

The lighting of the bridge is provided for by four gas-lamps fixed on the upstream side, the end lamps having three lanterns carried on cast-iron standards, and the two intermediate lamps having one lantern each, carried on 3 inches by 3 inches by ⅜-inch arched angle-bar standards. The lamps are fixed with special connections, so as to be easily removed in the wet season to leave the surface of the bridge clear for the passage of flood waters over it. Several floods occurred during the construction of the bridge, that on the 17th February, 1896, rising to a level of 85·39 feet, or within 14·46 feet of the great flood in 1893; and since the completion of the bridge two heavy floods have passed over it, doing no damage whatever to the structure of the bridge, which stood the severe tests admirably, the only damage sustained being to the roadway as already described.

The total cost of the bridge and approaches, including engineering and supervision, amounted to £25,000. The first contractor having failed financially in May, 1895, before much work was done, a second contract for the construction of the bridge had to be let; the successful tenderers were Messrs. McArdle and Thompson of Brisbane, who signed their contract on 26th July 1895, the time allowed for the completion of the work being 15 months. The contractors completed their work within contract time in a

highly creditable manner; the bridge being novel in character, and the river subject to frequent floods, the work was not carried through without some difficulties, which, however, were successfully overcome.

The bridge was formally opened for traffic with some ceremony on the 30th October, 1896, by the Hon. David Hay Dalrymple, M.L.A., Minister for Public Works, in the presence of a large and representative assembly of the public, and the structure was named the Lamington bridge, in honour of His Excellency the Right Hon. Baron Lamington, K.C.M.G., Governor of Queensland.

In concluding this Paper, the Author has much pleasure in acknowledging the able assistance rendered by the Resident Engineer on the works, Mr. Alfred J. Goldsmith, M. Inst. C.E., to whose fertility of resource, engineering skill, painstaking and vigilance, extending over a period of 2 years, must be attributed in a large measure the successful completion of the structure, the first of its kind in Australia.

The Paper is accompanied by four drawings and four photographs, from a selection of which Plate 1 has been prepared.

APPENDIX.

The following are the prices paid for the different descriptions of work in the bridge and approaches :—

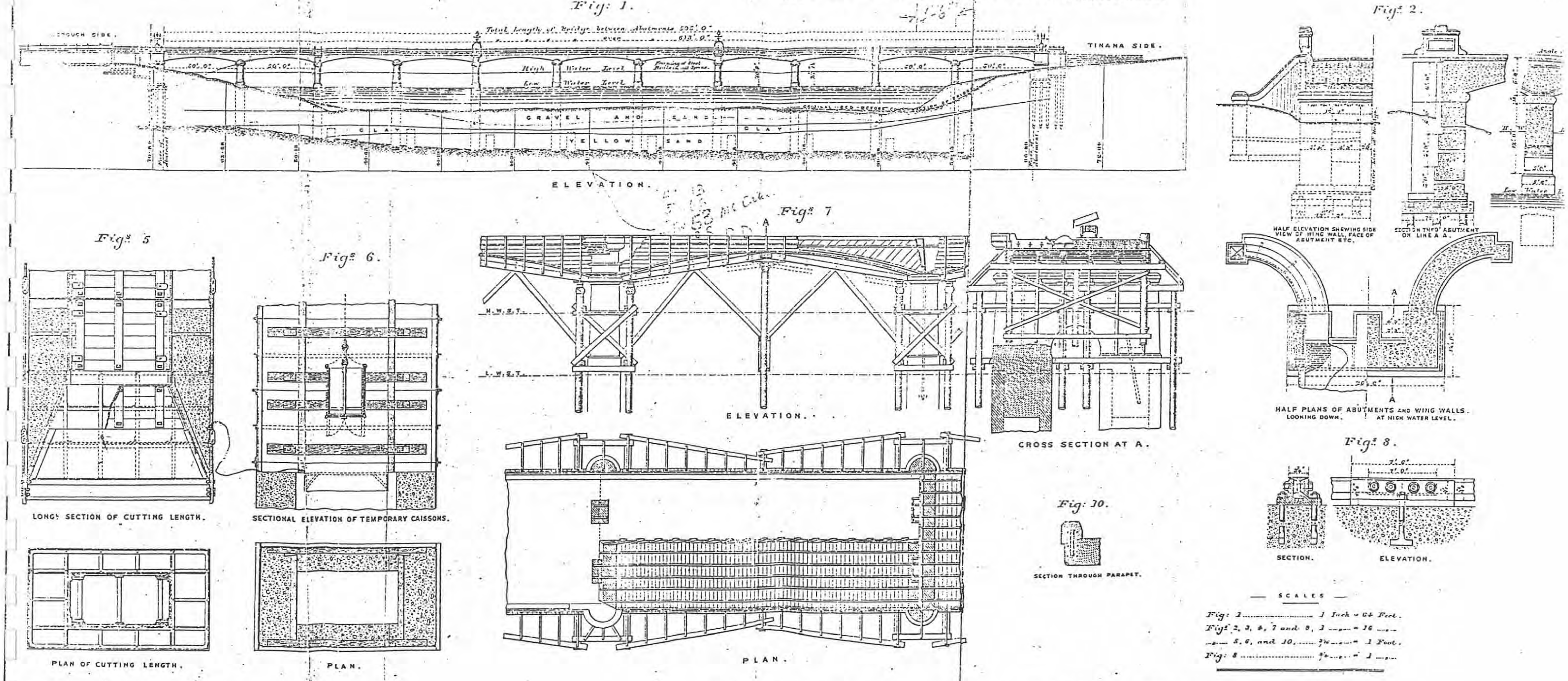
	£	s.	d.	
Excavation in abutment foundations . .	0	3	0	per cubic yard.
,, ,, pier foundations (including cost of staging[1] and wrought-iron caissons, also levelling surface of rock bottom) .	5	0	0	,, ,, ,,
Ironbark piles for abutment foundations .	0	3	6	,, linear foot.
Sawn hardwood in capsills and planking .	0	3	6	,, cubic ,,
Wrought iron in pile shoes and spikes . .	0	0	4	,, lb.
Cement concrete (5 stone, 2 sand, and 1 cement) in abutments	1	15	0	,, cubic yard.
Cement concrete in piers (5, 2, and 1) . .	2	3	0	,, ,, ,,
,, ,, ,, imposts (4, 1½, and 1)	2	7	0	,, ,, ,,
,, ,, ,, arches (4, 1½, and 1) .	3	1	0	,, ,, ,,
,, ,, ,, parapets, copings, &c. (4, 1½, and 1)	2	10	0	,, ,, ,,
Rubble stone backing to abutments . .	0	4	0	,, ,, ,,
Freestone coping and lamp bases . . .	0	9	0	,, ,, foot.
Cast-iron chairs to skeleton framing . .	1	0	0	,, cwt.
Wrought iron in bolts, nuts, &c. . . .	0	0	5	,, lb.
,, ,, ,, angles and rivets . . .	1	0	0	,, cwt.
,, gully-frames, gratings, cramps, dowels, &c.	3	0	0	,, ,,
Steel railway rails to skeleton framing, straight	9	0	0	,, ton.
Steel railway rails to skeleton framing, curved and forged	14	0	0	,, ,,
Steel in fish-plates, and covers to all connections	30	0	0	,, ,,
Hardwood block paving on bridge . . .	0	14	0	,, square yard.
Excavation for approaches	0	2	0	,, cubic ,,
Stone pitching 7 inches deep on embankments	0	4	0	,, superficial yard.
Metalling on roadways of approaches . .	0	9	0	,, cubic yard.
Wages of labourers	0	0	9	,, hour.

[1] The cost of staging was equal to about 8*s.* per cubic yard of excavation; the actual cost of the wrought iron caissons, including conveyance from the banks of the river, fixing and jointing, and cost of lowering gear, was equal to about £2 16*s.* 3*d.* per cubic yard of excavation.

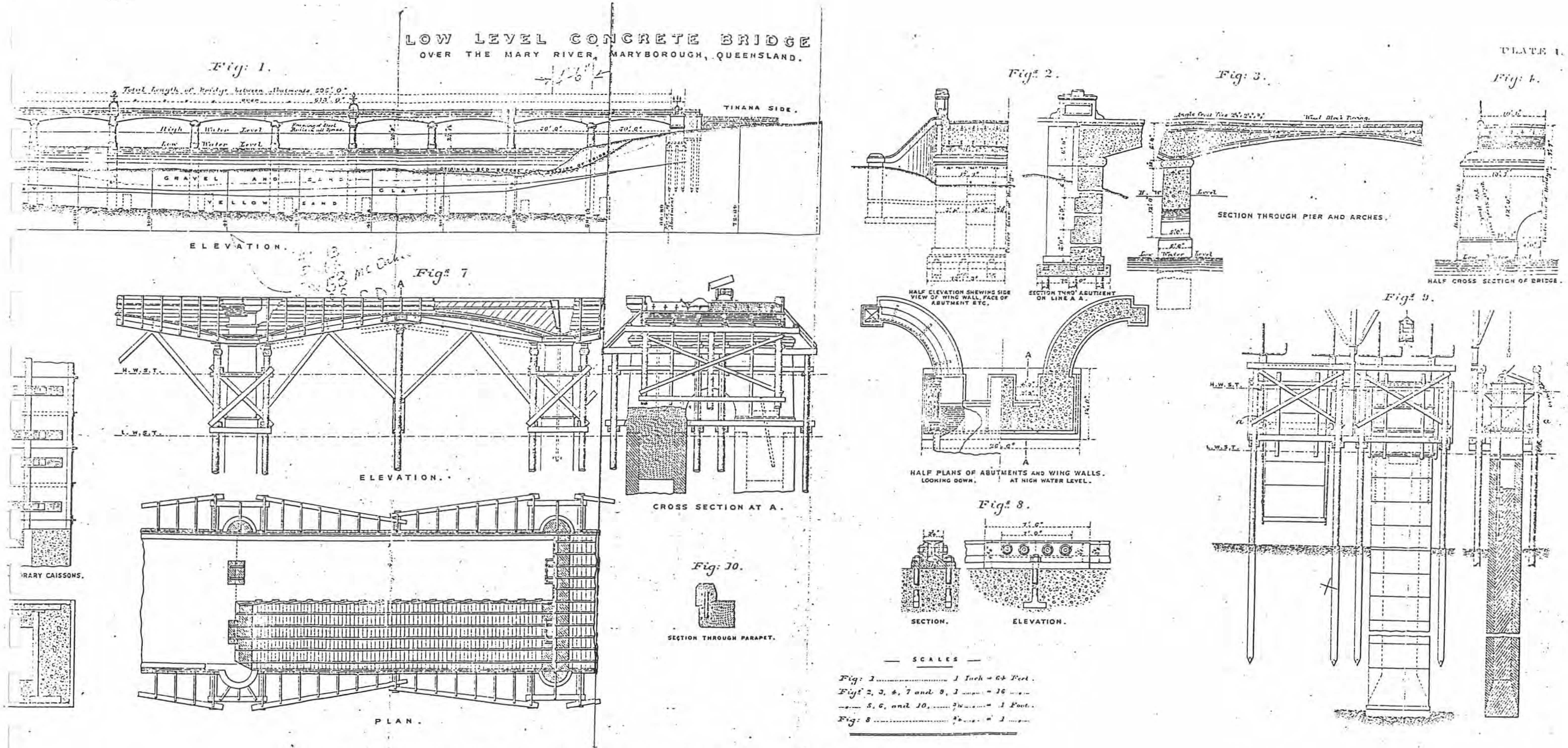
QUANTITIES OF PRINCIPAL ITEMS IN BRIDGE.

Excavation in foundations of piers and abutments .	1,250 cubic yards.
Piles in abutment foundations	565 linear feet.
Wrought iron in pile shoes	532 lbs.
Portland-cement concrete in bridge	4,270 cubic yards.
Cast iron in chairs to skeleton framing	3·53 tons.
Steel and ironwork in skeleton framing to superstructure	88·11 „
Wrought iron in anchor bolts, plates, gullies, sockets, cramps, dowels, &c.	2·63 „

LOW LEVEL CONCRETE BRIDGE
OVER THE MARY RIVER, MARYBOROUGH, QUEENSLAND.



A.B. BRADY.



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Early Queensland Road Bridges

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The First Bridges

There is little doubt that Queensland's first bridge was in Brisbane, at the junction of Adelaide and Albert Streets, across Wheat Creek, which flowed from the present Roma Street railway yards to join the Brisbane River at the foot of Creek Street.

John Steele[1] has described the early geography of Brisbane. From the wharf below the Commissariat Store, a road led up the bank to a point near the northern end of the present Victoria bridge. The southern portion of Queen Street was laid out by Logan in 1826, and served the Prisoners' Barracks, a large stone building in the block bounded by Queen, Albert, Adelaide and George Streets. There was a track along the high ground between the William Jolly Bridge and Parliament House, and another from the Prisoners' Barracks to the Botanical Gardens and the Stone Wharf near the foot of Edward Street. The Windmill or Observatory, still standing in Wickham Terrace, was built about 1827, and was reached by a road which wound up the hill, from the rear of the Prisoners' Barracks, across the first bridge. When Cunningham surveyed the settlement in 1829 he crossed this bridge, so it can be assumed that it was built about 1827.

In September, 1829, Logan wrote "I have commenced the new Agricultural Station" at Eagle Farm[1]. This was reached by a road which branched from the route to the Mill, passing around the bend in the river opposite the present Kangaroo Point, then through the wheat fields of New Farm, across the mouth of Breakfast Creek, and along the river bank to Eagle Farm. About 1835, this route was modified by the construction of a second bridge across Wheat Creek, in Queen Street, a little north of the intersection of Creek Street. By 1836 there was also a bridge on this road across Breakfast Creek.

Early Brisbane Town was drained by two creeks—Wheat Creek, and another smaller stream which drained the land between Mary and Margaret Streets, and joined the river east of the junction of Margaret and Edward Streets. An early drawing, of 1835, appears to show a bridge over the mouth of this creek, along a track following the riverbank. This track may have also crossed Wheat Creek by a bridge, for one is indicated on a plan of 1843. There was also an early bridge across Kedron Brook, near Hedley Avenue, on the road from Eagle Farm to the Lutheran mission at Zion's Hill at Nundah.

Nothing is known of the construction of these early bridges, although it may be expected that they were of timber. Some information is available about their successors. In 1861, a stone culvert was built on the site of the first crossing of Wheat Creek. This was 19.2 m long, with an ovoid cross-section approximately 1.2 m wide by 1.5 m high. It ran along the centreline of Adelaide Street, across Albert Street, and was approached by oblique, open, timber framed channels at each end, running in an easterly direction from King George Square, and into the site at present occupied by Wallace Bishop's. E.L. Richard, who provided this information, records the construction of this drain in his paper, "Historic Drains of Brisbane"[2]. He also refers to the Frog's Hollow Drain, built in 1859 to enclose the smaller creek near Margaret Street.

The Oxley Library has photographs of some other early Brisbane bridges. The second bridge at the mouth of Breakfast Creek had three timber bow-string truss spans, built about 1857/8 on stone piers. The first Norman Creek bridge was built at its junction with the Brisbane River about 1856, and had half-through lattice trusses in timber. Another photograph shows what is believed to be the first Bowen bridge, 1860, with understrutted timber girders and stone piers, across Breakfast Creek below the present Royal Brisbane Hospital.

Timber and Masonry

Most Australian States have at least some early stone bridges—Queensland being the exception. Apart from some small stone arch culverts built for the Cooktown-Laura railway, no old stone bridges have been firmly identified in Queensland, although unconfirmed information has been provided about two. It is said that there is a masonry arch in the old mining town of Ravenswood, and another on the previous line of the Beenleigh to Redland Bay Road. The arch bridge across Crystal Creek at Mount Spec looks like a stone bridge, but is in fact a concrete arch faced with stone. It was built in 1932. There is, however, an old brick culvert at Dalrymple Gap, on the Valley of Lagoons Road, south of Cardwell. This was built by Dalrymple in 1864 or 5 and has a single waterway of circular cross-section, about 1.5 m in diameter, lined with a double thickness of bricks. It still stands.

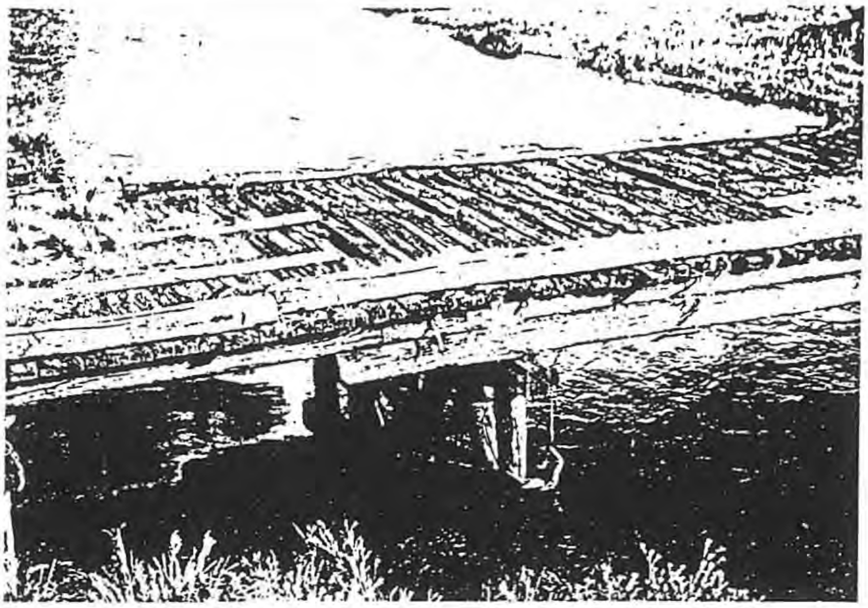
The earliest bridges were undoubtedly built in timber, and it is only the relative lack of durability of this material that has caused few, if any, to survive.

Steele's book[1] includes Dixon's map of 1842 which shows some of Queensland's earliest roads. One commenced opposite the wharf and the commissariat store of Brisbane Town and proceeded south to Cowper's Plains—now Coopers Plains, near Archerfield. From there the traveller had the choice of three routes—east through Capalaba to Cleveland; south to Slacks Creek, the Logan, and Mundoolun; and west to Limestone or Ipswich. The Moreton Bay colony was opened up to free settlement in 1842. News of this intention led to a land rush in the early 1840's, headed by the Leslie brothers, who travelled overland from New South Wales to the Darling Downs in 1840. Hodgson settled near Drayton, south of Toowoomba in 1840. The first route from these settlements to Brisbane passed through Cunningham's Gap, but in 1847 Spicers Gap was rediscovered and became the major route from the south to Brisbane. Gill[3] has described the history of this road. A little earlier in 1841, Gorman, the last commandant, established a route from Brisbane to Drayton, crossing the range at Gorman's Gap, south of Toowoomba.

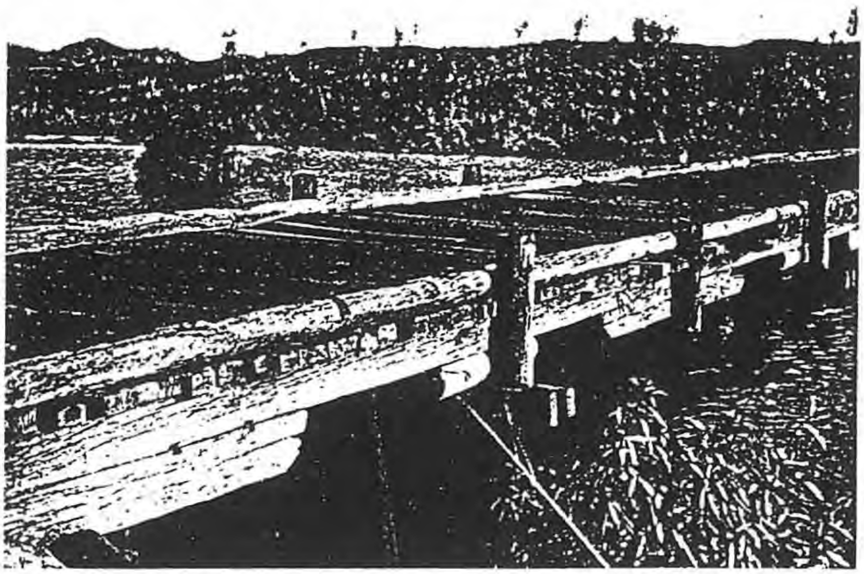
A Report from a Select Committee on Internal Communication, 1860[4], also describes some early roads— (1) from Brisbane to Ipswich; (2) from Ipswich to Drayton; (3) on the Darling Downs; (4) from Ipswich to Warwick; (5) the North Road, from North Brisbane to Gayndah; (6) the Brisbane River road (also to the Burnett); (7) from Maryborough to Gayndah; (8) at Port Curtis and Rockhampton; (9) from Brisbane to the Logan; and (10) from Brisbane to Moggill. There were bridges either built or proposed on many of these roads.

Some relics of these early roads still exist. There are, for example, the burnt out remains of a timber bridge on the western approach to Spicers Gap. To the west of Forest Hill is Sanger's bridge across Sandy Creek on the old Toowoomba road. It has been suggested that this was built about 1864; if this were confirmed then the bridge would be one of Queensland's oldest existing bridges. Unfortunately, one of the timber piers was washed out in 1959, and the bridge is now in ruins.

It appears probable, therefore, that there are old timber bridges that are still standing, and which have not yet been identified. For this reason it is useful to observe features which characterise some of the older bridges. The old Murrumba bridge across the Brisbane River, will soon be covered by the rising waters of Wivenhoe Dam. Although undated, it was probably built about 1900. Each pier consists of piles capped with a single solid piece of timber. This solid cap appears to be characteristic of all old timber bridges, whether road or rail, and in all Australian states, and is the best indicator of age. The caps were socketed to form a mortice and tenon joint to the piles; this led to difficulties in replacing the cap, and so in later bridges two capping pieces, called half caps, were used, let into opposing faces of the piles. In the Murrumba bridge, the pier braces are placed between the piles, rather than being bolted to their faces, and this also is a sign of age. The span at the right uses double girders, but this is not uncommon, particularly for later railway bridges.



Brisbane River Bridge at Murrumba (undated).



Northbrook Bridge with alternate new piers (undated).

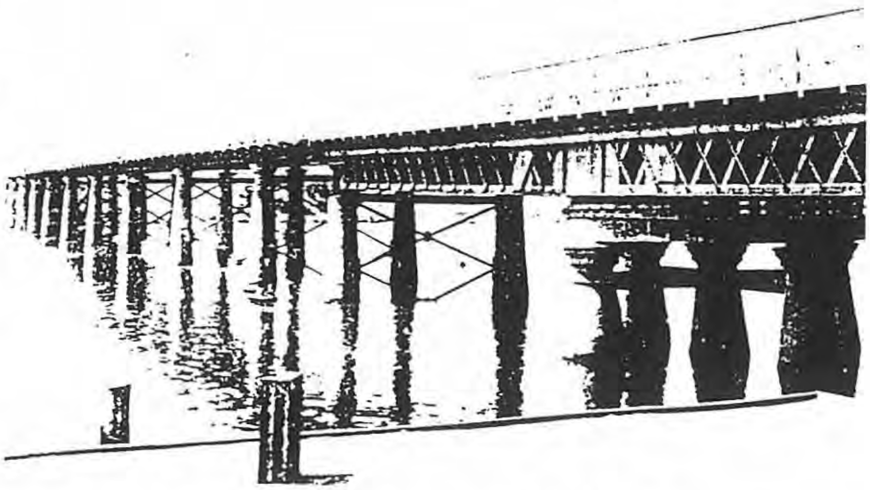
Early Metal Bridges

The first substantial metal bridge in Queensland was probably the original railway bridge across the Bremer River at Ipswich, built as part of Queensland's first railway from Ipswich to Grandchester in 1865. The line from Ipswich to Brisbane used a metal truss bridge to cross the Brisbane River at Indooroopilly, and was opened in 1876. Neither of these bridges still exist.

The first permanent road bridge over the Brisbane River was the first Victoria bridge. It was commenced in 1864 but because of financial difficulties was not completed until 1874. As the photograph shows, it had a swing span near the south bank. Undoubtedly this was originally planned to provide for river traffic to the rail terminus at Ipswich, but, in the event, the railway extension to Brisbane rendered the navigation span unnecessary and it was rarely used. The major part of the bridge consisted of 11 fixed lattice-truss spans, mostly of 25 m. Of these, the flood of 1893 destroyed the six spans adjacent to the northern abutment and the five intermediate piers. The pier at the northern end of the swing span was also undermined and destroyed, being found later to have fallen upstream[4].

A temporary timber bridge was in use on the same site from 1865 until about 1867 or 1869, and another from 1893 to 1896. The second permanent Victoria bridge was completed in 1897, and was similar to the Burnett River bridge at Bundaberg which still stands, and will be described later.

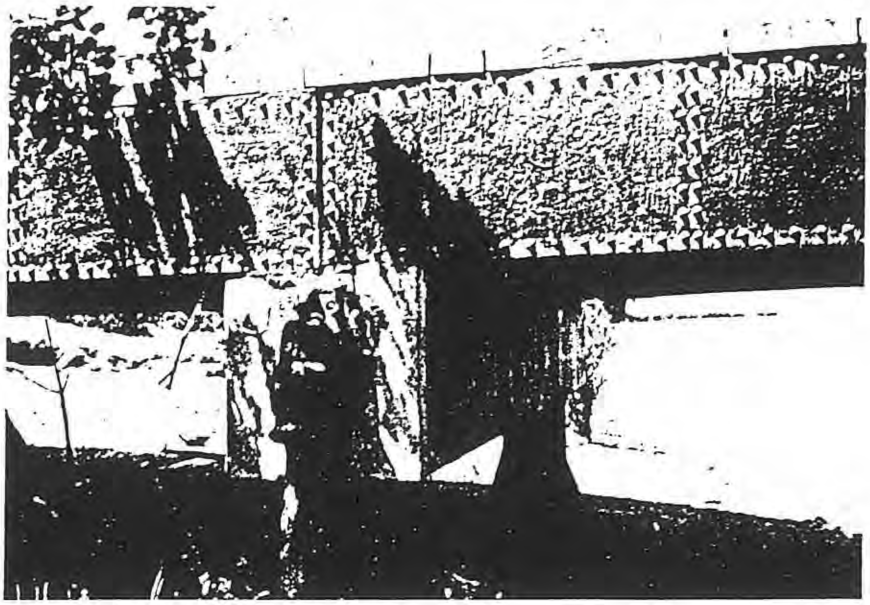
The nearby Northbrook bridge, also to be flooded, has had its spans halved by the addition of intermediate piers. The older piers can be recognised by the use of longer corbels. In this photograph it appears that the older solid caps are attached to the sides of the piles, but this is deceptive as other views suggest that the pile which extends above the deck is an additional member, and that the main load bearing piles are beneath the cap. The old, long corbels are of squared timber, and have curved ends—in some bridges, these ends were further shaped to a decorative profile—and these features also suggest that the bridge is old. It may also be noted that slots were formed to accommodate shear keys between the girders and the corbels. Shear keys of this type, or between double girders, were used in some of the earlier timber bridges, but this is not as reliable an indicator of age as the use of full caps.



The first Victoria Bridge Brisbane (1874). (Courtesy of the Oxley Library).

Some Important Existing Bridges

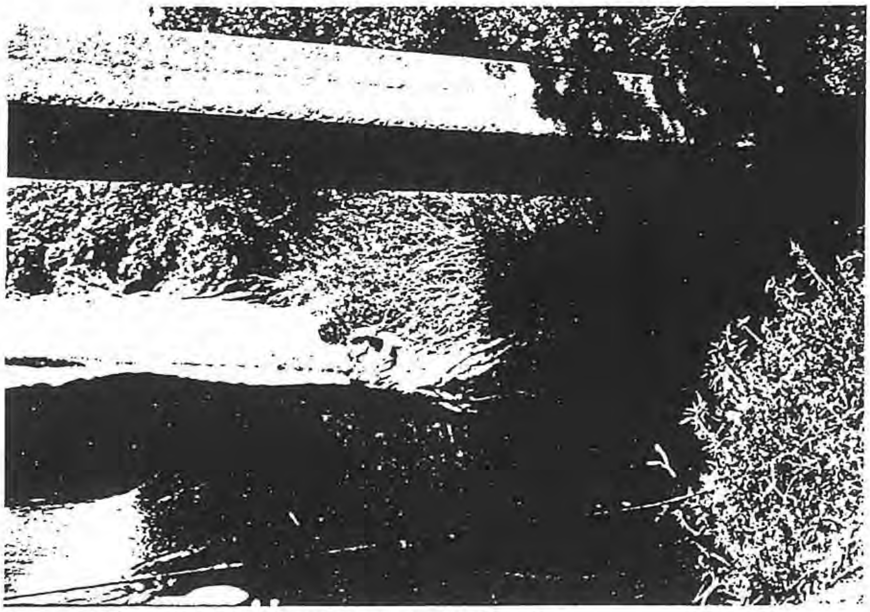
The Annan River bridge, completed in 1888, is one of Queensland's most important existing bridges. It is quite a large bridge, with twenty-two 15.3 m spans. The timber decking rests directly on five longitudinal plate girders, of which the outer ones are unusual, with their asymmetrical cross-section resulting from the omission of the outer flange angles. The bridge is located 9 km south of Cooktown, and the presence of such a large bridge in what is now a remote location is a reminder of the importance of Cooktown and the goldfields of the Palmer River. There was, in fact, a similar nine span bridge over the Endeavour River north west of Cooktown, of which 6 spans have been reconstructed and 3 remain in original form. There was another across Sandy Creek, south of Mackay, and possibly a fourth across Barnes Creek north of Mackay.



Annan River Bridge, south of Cooktown (1888).

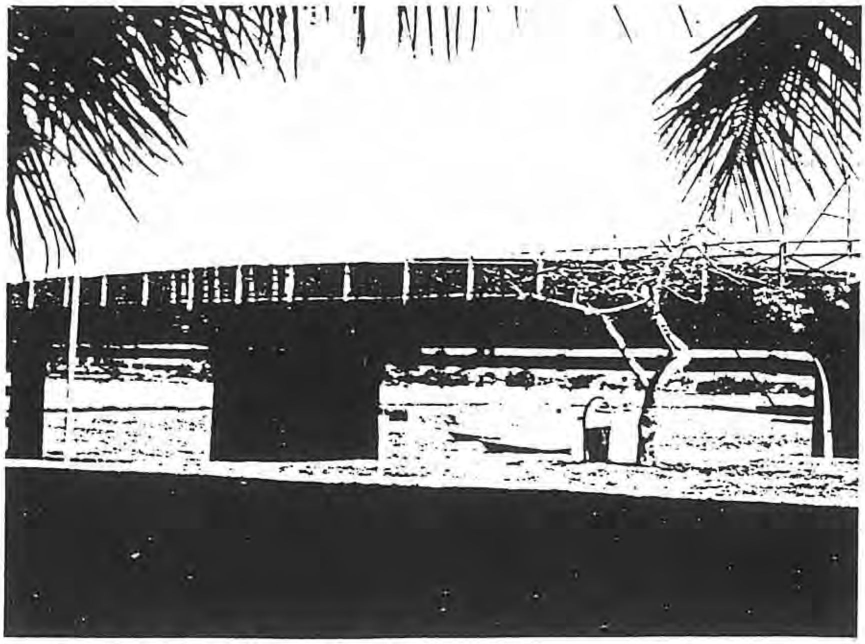
The photo shows concrete encasement of the pier cap, and this is modern. The cap rests on two cast iron screw piles, with solid diagonal races upstream and downstream screwed into the river bed. The original bridge had on ingenious collapsible railing which could be let down in time of flood. This has since been removed, but its components may still be seen at the northern end of the bridge.

Another important old bridge is the Gairloch bridge, over the Herbert River north-east of Ingham. Completed in 1890, it was designed by Alfred Barton Brady, who also designed the second Victoria bridge and many others. Gairloch bridge has fourteen 10.2 m spans, and was designed as a low level bridge. As shown in the photo, the deck is supported on longitudinal troughing. The concrete kerb is new, as the original bridge had timber kerbs retaining the 'tarred metalling' placed on top of the troughing to form the roadway. In his paper describing the bridge[5], Brady spoke of the advantages in using this form of construction for low-level bridges, because of the "little resistance to the passage of flood waters during the wet season". The way in which concrete was used in the piers and abutments of the bridge is also of interest.



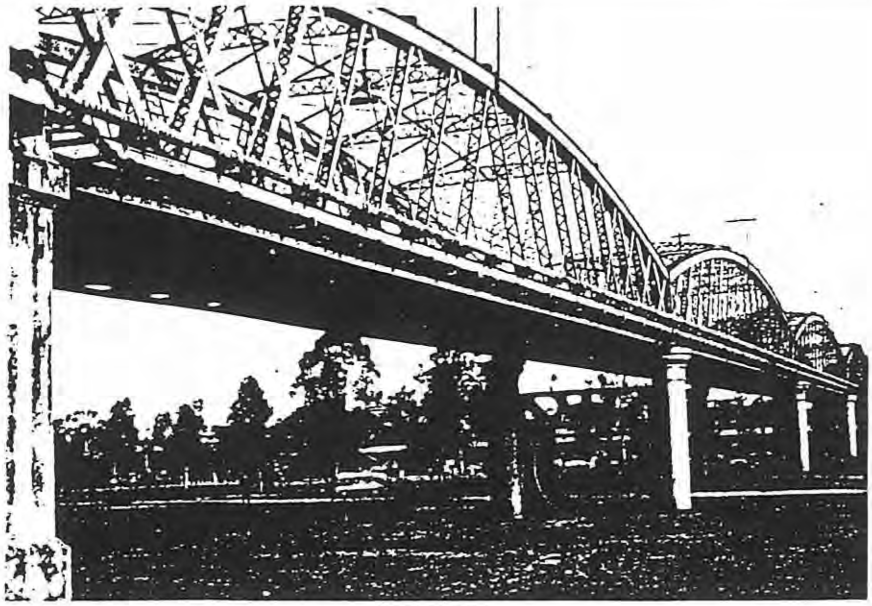
Gairloch Bridge across the Herbert River north of Ingham (1890).

The Victoria swing bridge over Ross Creek at Townsville dates from about 1889. Its main spans, each of 22.9 m, are large for the time, and were equalled only by the bridge at Sale in Victoria, built earlier in 1883 with the same spans. however the bridge at Sale is a truss bridge, whereas that at Townsville has plate girders with a buckle plate deck, this being unusual in Queensland. The swing mechanism is also of interest.



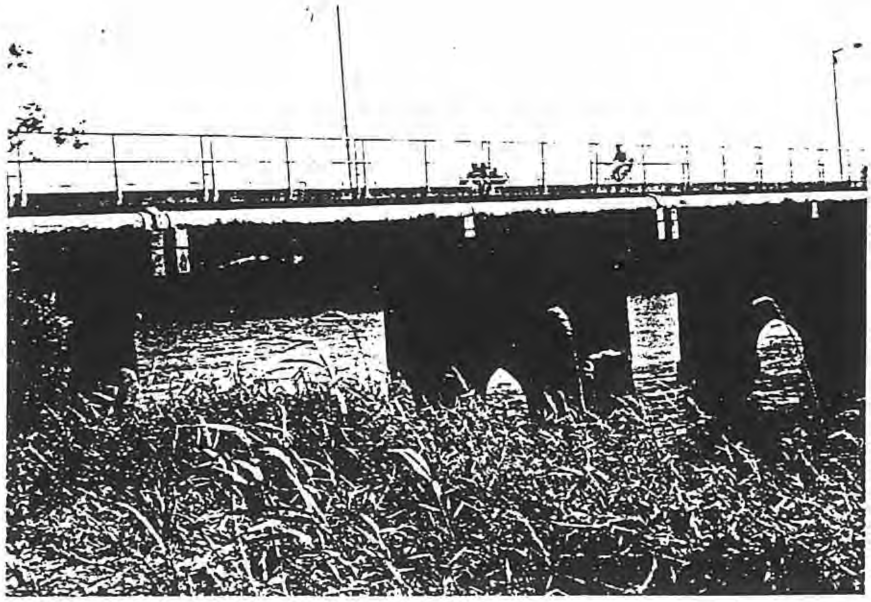
Ross Creek Swing Bridge, Townsville (c 1889).

Brady designed three similar truss bridges all placed into service between 1897 and 1900—the second Victoria bridge, 1897; the Kennedy bridge at Saltwater Creek, Bundaberg, 1899; and the Burnett River bridge at Bundaberg, 1900. The last of these[6] was the longest, with eight spans, 51.9 m between centres of piers, and is still in use. The adjacent Saltwater Creek bridge has a single, similar span, whereas Victoria bridge had six such spans. Victoria bridge, however, differed from the others in that it had a wider roadway, split between three trusses.



Burnett River Bridge, Bundaberg (1900).

Queensland is notable for its early use of concrete in bridge construction, both for rail and road bridges. The Lamington bridge[7] across the Mary River south of Maryborough is significant among world bridges, both because of its early date, and also for its size. It is effectively a continuous girder, with 13 spans—eleven 16.6 m interior spans, and two 7.5 m end spans. It was designed by Brady and placed in service in October 1896. The first concrete arch bridge in the world dates from about 1890, and reinforced concrete did not come into use until about 1900. Brady thought of the Lamington bridge as a flat arch, but its reinforcement and form is such that its behaviour would more likely be that of a continuous girder.



Lamington Bridge, Maryborough (1896).

Some Other Early Bridges

There are some other early bridges which deserve mention, even though they are no longer in service.
The suspension bridge across the Fitzroy River at Rockhampton, built about 1880, was one of Australia's major bridges, with spans of 26.5, four at 70.7 and 26.5 m. It was the largest span Australian bridge from 1880 until 1889 when it was surpassed by the 125 m span Hawkesbury rail bridge.

Logan River Bridge at Maclean (c 1880).

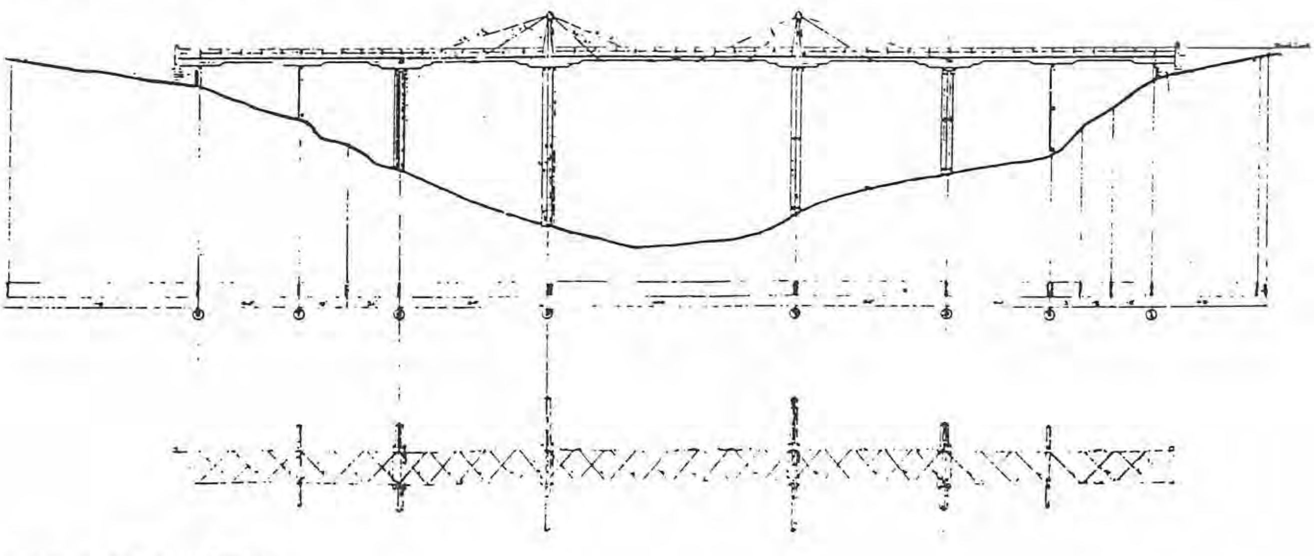


Figure 1 Maclean Bridge

Although suspension bridges are rare in Australian practice, the Fitzroy River bridge started something of a tradition for Queensland, for it was followed about 1906 by the 107 m span suspension bridge over Sandy Creek south of Mackay, and the present Indooroopilly suspension bridge, completed in 1936 with a main span of 183 m.

There were also two remarkable braced timber girder bridges. The Alligator Creek bridge near Yaamba north of Rockhampton had an unusual system of understruts and braces. Timber posts were placed beneath the deck at the one-sixth points. From the base of the central post, diagonal ties ran to each end of the main girder. Other ties went from the base of each other post to the nearer end of the main girder, and also to the top of the adjacent post on the mid-span side. Unfortunately it has not been dated, but it appears to have had a span of about 25-30 m.

Figure 1 is taken from the original drawings of a cable-stayed girder bridge built across the Logan River at Maclean about 1880, and which remained in service for about 60 years, until it was replaced by the present bridge in 1939. This bridge was of particular interest, for it is commonly stated that the cable stayed girder system was not used until after the Second World War. The drawings show that the old Maclean bridge was a conscious design, with careful detailing of the tension rods and of the tall timber towers.

Conclusion

It is hoped that this brief article may inspire some readers to come forward with new information, either of the bridges described here, or of other bridges of historic interest. Letters may be addressed to the author, at the Department of Civil Engineering, University of Queensland, St Lucia. Acknowledgement is made of the assistance given by E. L. Richard in regard to Reference 2 and the early Brisbane drains.

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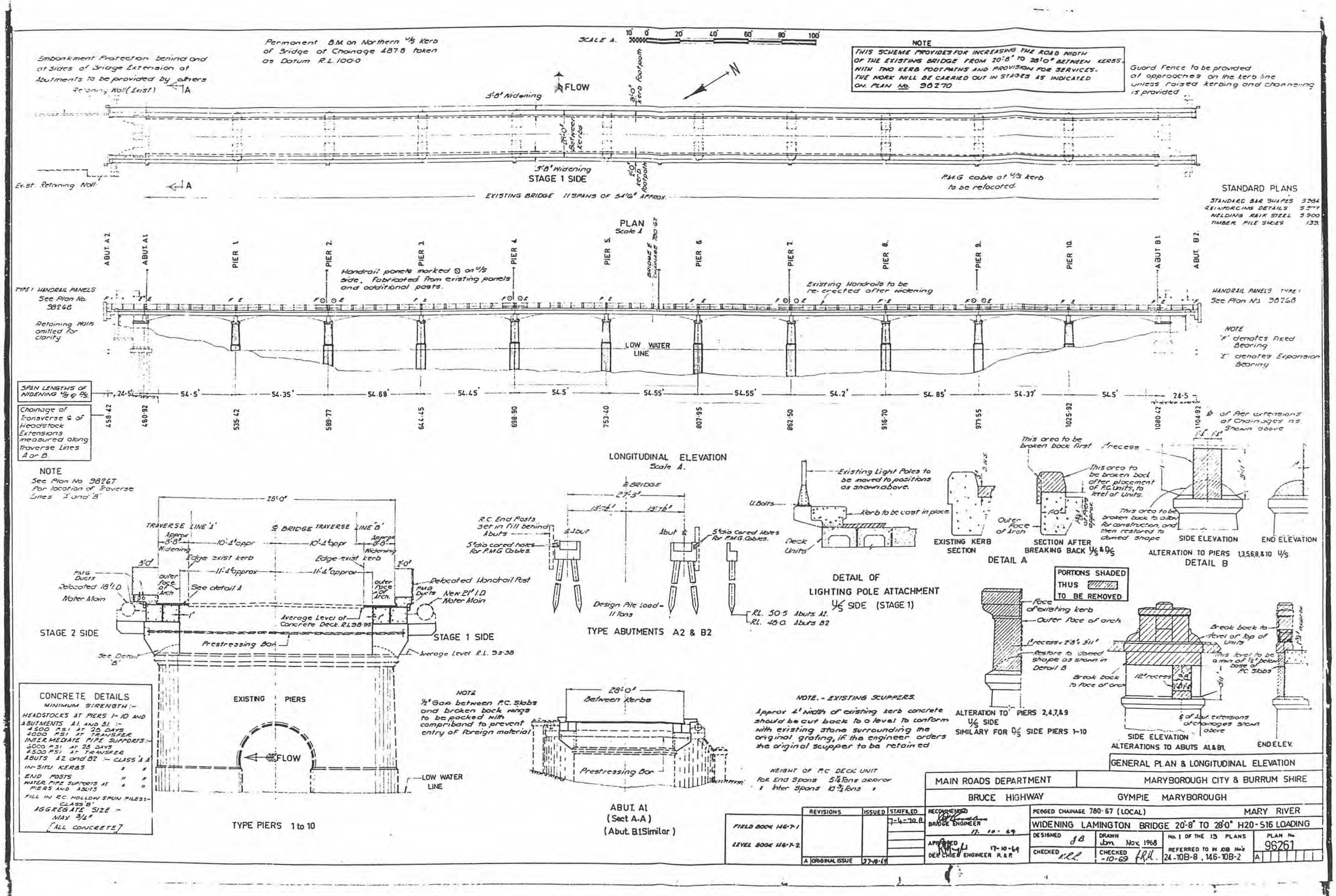
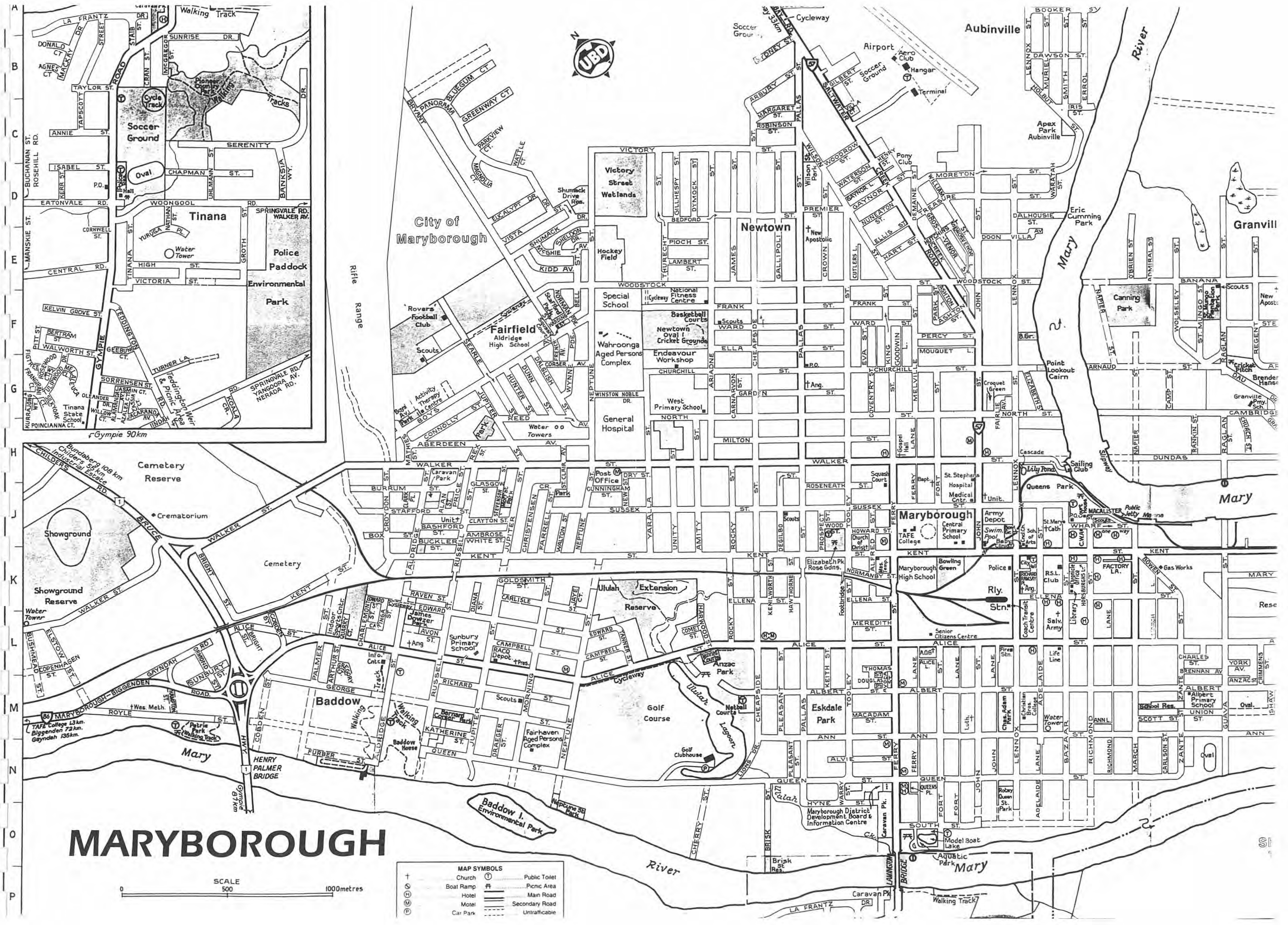


Embankment Protection behind and at sides of Bridge Extension at Abutments to be provided by others
Permanent B.M. on Northern U/S Kerb of Bridge at Chainage 487.8 taken as Datum R.L. 100.0
SCALE A. 10' 0 20' 40' 60' 80' 100'
NOTE
THIS SCHEME PROVIDES FOR INCREASING THE ROAD WIDTH OF THE EXISTING BRIDGE FROM 20'8" TO 28'0" BETWEEN KERBS WITH TWO KERB FOOTPATHS AND PROVISION FOR SERVICES. THE WORK WILL BE CARRIED OUT IN STAGES AS INDICATED ON PLAN No. 98270
Guard Fence to be provided at approaches on the kerb line unless raised kerbing and channelling is provided
FLOW
3'8" Widening
28'-0" Between Kerbs
3'8" Widening
STAGE 1 SIDE
Exist. Retaining Wall
P.M.G. cable at U/S kerb to be relocated.
EXISTING BRIDGE 11 SPANS OF 54'6" APPROX.
PLAN
Scale A
STANDARD PLANS
ABUT. A2
ABUT. A1
PIER 1
PIER 2
PIER 3
PIER 4
PIER 5
PIER 6
PIER 7
PIER 8
PIER 9
PIER 10
ABUT. B1
ABUT. B2
Handrail panels marked ⊗ on U/S side, Fabricated from existing panels and additional posts.
Existing Handrails to be re-erected after widening
TYPE 1 HANDRAIL PANELS See Plan No. 98268
HANDRAIL PANELS TYPE 1 See Plan No. 98268
Retaining Walls omitted for clarity
NOTE
'F' denotes Fixed Bearing
'E' denotes Expansion Bearing
LOW WATER LINE
SPAN LENGTHS OF WIDENING U/S & D/S.
24.5' 54.5' 54.35' 54.68' 54.45' 54.5' 54.55' 54.55' 54.2' 54.85' 54.37' 54.5' 24.5'
Chainage of Transverse ℄ of Headstock Extensions measured along Traverse Lines A or B.
458.42 480.92 535.42 589.77 644.45 698.90 753.40 807.95 862.50 916.70 971.55 1025.92 1080.42 1104.92
℄ of Pier extensions at Chainages as shown above
NOTE
See Plan No. 98267 for location of Traverse Lines 'A' and 'B'
LONGITUDINAL ELEVATION
Scale A.
28'0"
TRAVERSE LINE 'A'
℄ BRIDGE
TRAVERSE LINE 'B'
See detail A
Relocated Handrail Post
New 21" I.D. Water Main
Relocated 18" I.D. Water Main
Average Level of Concrete Deck R.L. 98.95
STAGE 2 SIDE
STAGE 1 SIDE
Prestressing Bar
EXISTING PIERS
FLOW
LOW WATER LINE
TYPE PIERS 1 to 10
℄ BRIDGE
27'3"
R.C. End Posts set in fill behind Abuts
5" dia cored holes for P.M.G. Cables
Design Pile Load = 11 Tons
R.L. 50.5 Abuts A2.
R.L. 48.0 Abuts B2
TYPE ABUTMENTS A2 & B2
NOTE
½" Gap between P.C. Slabs and broken back wings to be packed with compriband to prevent entry of foreign material
28'0" Between Kerbs
Prestressing Bar
ABUT. A1
(Sect A-A)
(Abut. B1 Similar)
Existing Light Poles to be moved to positions as shown above.
U Bolts
Kerb to be cast in place
Deck Units
DETAIL OF LIGHTING POLE ATTACHMENT
U/S SIDE (STAGE 1)
EXISTING KERB SECTION
SECTION AFTER BREAKING BACK U/S & D/S
DETAIL A
SIDE ELEVATION
END ELEVATION
ALTERATION TO PIERS 1,3,5,6,8,&10 U/S
DETAIL B
PORTIONS SHADED THUS TO BE REMOVED
NOTE. - EXISTING SCUPPERS.
Approx 4" width of existing kerb concrete should be cut back to a level to conform with existing stone surrounding the original grating, if the engineer orders the original scupper to be retained
WEIGHT OF P.C. DECK UNIT
For End Spans 5¼ Tons approx
Inter Spans 10¾ Tons
ALTERATION TO PIERS 2,4,7,& 9 U/S SIDE
SIMILARY FOR D/S SIDE PIERS 1-10
SIDE ELEVATION
ALTERATIONS TO ABUTS A1 & B1
END ELEV.
CONCRETE DETAILS
MINIMUM STRENGTH:-
HEADSTOCKS AT PIERS 1-10 AND ABUTMENTS A1 AND B1 :- 4500 P.S.I. AT 28 DAYS 4000 P.S.I. AT TRANSFER
INTERMEDIATE PIPE SUPPORTS:- 5000 P.S.I. AT 28 DAYS 4500 P.S.I. AT TRANSFER
ABUTS A2 and B2 - CLASS 'A'
IN-SITU KERBS
END POSTS
WATER PIPE SUPPORTS AT PIERS AND ABUTS
FILL IN R.C. HOLLOW SPUN PILES:- CLASS 'B'
AGGREGATE SIZE :- MAX ¾"
[ALL CONCRETE]
GENERAL PLAN & LONGITUDINAL ELEVATION
MAIN ROADS DEPARTMENT
MARYBOROUGH CITY & BURRUM SHIRE
BRUCE HIGHWAY
GYMPIE MARYBOROUGH
PEGGED CHAINAGE 780·67 (LOCAL)
MARY RIVER
WIDENING LAMINGTON BRIDGE 20'8" TO 28'0" H20-S16 LOADING
FIELD BOOK 146-7-1
LEVEL BOOK 146-7-2
REVISIONS
ISSUED
STATFILED
A ORIGINAL ISSUE 27-10-69
RECOMMENDED BRIDGE ENGINEER 17-10-69
APPROVED DEP. CHIEF ENGINEER R.&P. 17-10-69
DESIGNED
CHECKED
DRAWN Nov. 1968
CHECKED -10-69
No. 1 OF THE 15 PLANS
REFERRED TO IN JOB No's 24-10B-8, 146-10B-2
PLAN No. 96261



MARYBOROUGH
City of Maryborough
Newtown
Aubinville
Granville
Fairfield
Tinana
Baddow
Maryborough
Mary River
Cemetery Reserve
Crematorium
Showground
Showground Reserve
Cemetery
Rifle Range
Airport
Aero Club
Hangar
Terminal
Soccer Ground
Apex Park Aubinville
Pony Club
Eric Cumming Park
Canning Park
Victory Street Wetlands
Shumack Drive Res.
Hockey Field
Special School
National Fitness Centre
Basketball Courts
Newtown Oval / Cricket Grounds
Wahroonga Aged Persons Complex
Endeavour Workshop
West Primary School
General Hospital
Water Towers
Aldridge High School
Rovers Football Club
Scouts
Post Office
Caravan Park
St. Stephens Hospital
Medical Cntr.
Army Depot
Central Primary School
TAFE College
Swim. Pool
Maryborough High School
Bowling Green
Police
R.S.L. Club
Library
Salv. Army
Coach Transit Centre
Senior Citizens Centre
Rly. Stn.
Queens Park
Sailing Club
Point Lookout Cairn
Ululah Extension Reserve
Golf Course
Golf Clubhouse
Ululah Lagoon
Anzac Park
Netball Courts
Eskdale Park
Chas. Adam Park
Sunbury Primary School
Fairhaven Aged Persons Complex
Baddow House
Walking Track
Baddow I. Environmental Park
Maryborough District Development Board & Information Centre
Model Boat Lake
Aquatic Park
Brisk St Res.
Albert Primary School
Oval
Henry Palmer Bridge
Lamington Bridge
Soccer Ground
Cycle Track
Oval
Pioneer Country Park
Police Paddock Environmental Park
Water Tower
Tinana State School
Teddington Weir & Picnic Area
Gympie 90km
Bundaberg 108 km
Childers 55 km
Industrial Estate
TAFE College 1.3 km.
Biggenden 72 km.
Gayndah 135 km.
Gympie 87 km
SCALE
0
500
1000metres
MAP SYMBOLS
Church
Boat Ramp
Hotel
Motel
Car Park
Public Toilet
Picnic Area
Main Road
Secondary Road
Untrafficable

HERITAGE

Enquiries: Mr I. Waples
Address: PO Box 645
TOOWOOMBA QLD 4350

Telephone: 076 332506 or 018 795034
Facsimile: 076 332810

Reference: 403/6/2
Date: 22 April 1996

TO: DISTRICT DIRECTOR (BUNDABERG)

SUBJECT: **CENTENARY OF LAMINGTON BRIDGE, MARYBOROUGH**

I refer to todays conversation re the Institution of Engineers (Heritage Panel) proposal to identify and bring deserved public recognition to this historic bridge by means of an Historic Engineering Marker (HEM) plaque. The HEM plaque would identify what the site is, who was involved and its engineering significance.

The Maryborough Wide Bay and Burnett Historical Society have agreed to incorporate a plaquing ceremony as part of the celebrations for 26 October 1996.

As the Department is the owner of the bridge would you please advise of the Departments agreement to the provision of a plaque, its location and public access to same. Also, if the Department wishes to participate in this plaquing ceremony on a joint project basis, recognition would be given on the plaque.

Your early advice would be appreciated.

Ian Waples
HERITAGE MANAGER

Main Roads
Queensland Department of Main Roads

QUEENSLAND GOVERNMENT

Facsimile Transmission

FROM: **Wide Bay District Office**

TO: MR IAN WAPLES

Fax Number 076 – 332810

Subject: CENTENARY OF LAMINGTON BRIDGE MARYBOROUGH

Your Reference: 403/6/2

Our Reference: 146/163/503

Date 7/5/1996

If problems occurred in the transmission of the documents, please contact:
Records Section Ext 237
Number of pages following - 1

MESSAGE:

Copy of A/ED(S)'s approval for your records.

FROM [signature]

Division/Branch/Section BUNDABERG QLD

Direct Telephone (071) 522355

Fax No 071 52 3878

PO Box 486
23 Quay Street
Bundaberg 4670 Qld

TRANSPORT

Queensland Department of Transport

Memorandum

Our Ref: 146/163/503 KJW/AEW 30A-4
Your Ref:
Date: 30 APR 1996

S. REGION

TO: EXECUTIVE DIRECTOR (SOUTHERN)
Toowoomba Qld

SUBJECT: CENTENARY OF LAMINGTON BRIDGE MARYBOROUGH

Attached is a copy of a letter dated 22 April 1996, received from the Heritage Manager, Mr Ian Waples, concerning this Department's involvement in a joint project for provision of an Historic Engineering Marker (HEM) Plaque for the above bridge.

In your letter dated 4 March 1996 to the Maryborough Family Heritage Institute Inc we have agreed to share some costs associated with the centenary celebrations with this association.

Similarly, it is recommended that the Department shares 50% of the cost of the HEM Plaque with the Institution of Engineers and participates in the ceremony for the unveiling of the plaque.

Your advice in due course would be appreciated.

10433

K Woodward

(K J Woodward)
ACTING DISTRICT DIRECTOR

* Enc (1)

QLD TRANSPORT - WIDE BAY
QUAY ST
7 MAY 1996
RECEIVED

Approved as requested
7-5-96

Enquiries: Mr Woodward
Telephone: 071 - 522355
Facsimile: 071 - 523878

B/c 1 DISTRICT DIRECTOR (WIDE BAY)

2 NEVILLE WINTER, MARYBOROUGH

3 IAN WAPLES, TOOWOOMBA

For your information. Copy of inwards attached.

(L J Louis)
EXECUTIVE DIRECTOR (SOUTHERN)
4 March 1996

QUEENSLAND TRANSPORT
Queensland Department of Transport

Regional Office (Southern)
Cnr Phillip and Clopton Streets
PO Box 645
Toowoomba QLD 4350

Enquiries: Mr L J Louis
Telephone: (076) 390700
Facsimile: (076) 390715
Our Ref: R2-LJL8.MAR GS 146/JOB
Your Ref: 128a.feb bh

4 March 1996

The Hon Secretary
Maryborough Family Heritage Institute Inc
PO Box 913
MARYBOROUGH QLD 4650

Dear Mr Perina

Re: Centenary Celebrations of the Lamington Bridge, Maryborough

Thankyou for your letter of 28 February 1996. I wish to confirm our interest in contributing to and being part of, the Centenary celebrations for the Lamington Bridge. Mr Neville Winter will be our local representative on the committee and he will keep the District Director fully informed of progress.

I also confirm the following:

(a) Closure of the bridge for three (3) hours on the day.

(b) The Department will restore the plaque.

(c) The Department will paint the bridge and arrange suitable lighting and decoration in conjunction with the organising committee.

(d) Participate in the Art Competition with the donation of a suitable prize. We will need to discuss the conditions applying to this.

I wish you well in the organising of this important function.

Yours sincerely

(L J Louis)
EXECUTIVE DIRECTOR (SOUTHERN)

Maryborough Family Heritage Institute Inc.

Ground Flo
Maryborough Heritage Cent
164 Richmond Stre
Maryborough Q 46
Austral

PO Box 91

Ph: (071) 231 62
Fax: (071) 231 88

28 February 1996

RECEIVED
- 1 MAR 1996
S. REGION

Mr L Louis
Executive Director
Department of Transport
PO Box 645
TOOWOOMBA QLD 4350

Dear Sir

Ref: Centenary Celebrations of the Lamington Bridge, Maryborough

Further to the Meeting held last Monday 26th inst., with yourself, Mr Keith Woodward and the Mayor (Councillor Brown), and our representatives, Mr Bill Hewitt and Treasurer Les York (Councillor) regarding proposed format of the above "Centenary". Reference was discussed regarding:

a) Closure of the Bridge for minimum of 3 hours.

b) Restoration of stone and marble existing plaque, of original opening of the Lamington Bridge.

c) Painting, flood lighting and decorating the Bridge for one (1) week prior and one (1) week after this important event.

d) As suggested Mr Hewitt will be in contact with the local Art Societies seeking necessary details regarding an Art Competition, suitable prize or prizes suitable to make this a Major Art Competition. Result of this will be communicated to you as soon as possible.

e) Should any formal requirements be necessary please advise as soon as practical.

Mr Neville Winter will be contacted on Wednesday night (28th inst.), asking that he be the Queensland Transports representative.

Enclosed, please find a copy of the proposed itinerary.

Thanking you in anticipation that this function will be achievable.

Yours faithfully

B J Perina

Bernie Perina
HON SECRETARY

File No. 10032		
OFFICER	ACTION	
	/	

bh
128a.feb

MARYBOROUGH QUEENSLAND

WHARF STREET PRECINCT

Lamington Bridge Centenary

Theme:
"Ye Olde Fair" Period Dress
(Town Crier and Mary Heritage)

Date:
Saturday, 26 October, 1996

Time Spread:
10 am for 12 Noon (Prelude)
Setting up, Aquatic Practice etc.

Major Function:
12 Noon to 6 pm

Evening:
"Bridge Centenary Banquet"
(VIP's - Dignitaries - Special Invitees and Public Persons ie @ $25 per head)

Bridge Closure:
ie 2pm to 5pm (if possible)

a) Art Societies to arrange "Art Competition" (a painting of the Lamington Bridge as it is today.
Sponsored Prize required.

b) Schools Competition.

c) Fishing Competition - Tagged fish in Lagoon - (Morning ie 10 am to 11.30 am.

d) Maryborough Players to arrange a re-enactment pertaining to this day 26 October 1896.

e) Local Bands - Scottish Pipers, Walkers and Maryborough City (each to perform on the Bridge).

f) Aquatics Display and activities on the Mary River - ie Canoe Races, Dinghy Races and Water Skiing Exhibitions.
Sponsor prize required.

g) Sail Past of Decorated Boats
Sponsored prize required.

h) Ye Olde Fair - Heritage Markets - Marketeers must sell Arts & Crafts etc relevant to the day.

i) Service Clubs - to provide food stalls (no duplication of foods).

j) Vintage Cars and Vintage Motor Bikes Parade.

k) "Cobb & Co" Horse drawn vehicles parade.

l) Printing of Official Program.

m) Restoration of existing "Plaque" (located northern end of bridge).

n) Bridge Flood Lighting and Bridge Decorations.

o) Necessary Prizes for Aquatic, Best Decorated Boat, Art, School competitions and Decorated Bicycle.

p) Prizes for Period Costumes - Best Male, Best Woman, Best Family, and Best Child (male & Female).
3 Judges required.

q) Comprehensive Mail Out, Letter Box Drops - and Necessary continuous Media, Radio and TV promotional coverage and advertising.

r) Letters to all similar Heritage Associations and Groups.

s) VIP invitations - ie Minister for Works, Minister for Environment and Heritage, Local Councils etc.

t) Keynote Guests - State Governor, Premier - plus?

u) Require a Stage and Top (as used in Queens Park during Heritage Festival).

v) Appropriate Sound Systems.

w) List of Descendants of 1896 Bridge Opening - Bridge Board Jas Fairlie, G Stupard, N Tooth, Mayor J M Stafford, Aldermen from Maryborough City Council and the Tinana Divisional Board John Parke and other leading citizens and commercial operators (Hynes, Walkers etc), Chief Engineer A B Brady, Mechanical Engineer A J Goldsmith and Contractors McArdle and Thomson.

x) VIP's etc to arrive to the function by Cobb & Co etc (or if necessary Surries and Coaches).

y) Apart from Heritage, this day is another Milestone in the History of Maryborough.

z) Necessary meetings of working committees as deemed necessary.

Maryborough
Wide Bay and Burnett Historical Society Inc.

Founded 22nd November, 1955

Meeting Night - 1st Monday in Every Month

PRESIDENT: S.K.Taylor

HON. SECRETARY P.J.Templeton
P.O.Box 84
Maryborough
Queensland 4650
10 Nov 1995

Mr I Waples
P.O.Box 645
Toowoomba
Queensland 4350

Dear Mr Waples,

Thank you for your interesting reply to our "Letter to the Editor".

We would like to take advantage of your offer of a copy of Mr A.P.Brady's paper "Low Level Concrete Bridge over the Mary River, Maryborough, Queensland".

We had been told that original plans in a metal canister were in the City Hall in 1977, but these cannot be found now. We would be most grateful for copies of the plans.

We also would be very pleased to incorporate a Plaquing Ceremony as part of our Big Day and are looking forward to further correspondence with you. Once again, thank you.

Yours sincerely,

Jackie Templeton (Mrs)

P.J.Templeton Hon. Sec.

TRANSPORT

HERITAGE

Address: PO Box 645
TOOWOOMBA QLD 4350
Enquiries: Mr I. Waples
Telephone: 018 795034
Our Ref.: 403/6/2
Date: 19 October 1995

Ms Jackie Templeton
Hon Secretary
MWB&B Historical Society
PO Box 84
MARYBOROUGH QLD 4650

Dear Ms Templeton

Centenary of Lamington Bridge, Maryborough

With reference to your letter published in the Toowoomba Chronicle on 25 August 1995 concerning the above, attached for your information are articles relating to the bridge. A copy of the Design Engineer A B Brady's paper, 'Low Level Concrete Bridge over the Mary River, Maryborough, Queensland' would be available upon request.

The Department has the original linen plans for this bridge;

* the bridge plan was signed on 11 June 1893
* the plan of approaches and fencing was signed on 18 June 1894
* some of the original plans have coloured in sections

and copies of these may be of interest for your celebrations.

Also for your information, the Institution of Engineers has an Australian Engineering Plaquing Programme which has been developed as a means of bringing deserved public recognition to historic engineering works and sites.
An Historic Engineering Marker (HEM) plaque, which would identify what the site is, who was involved, it's engineering significance and its social impact, is presently under consideration by the Institution of Engineers Heritage Panel (Queensland Division) for this bridge.

Would it be appropriate for a Plaquing Ceremony to be part of the celebrations planned for 26 October 1996?

Yours sincerely

Ian Waples
HERITAGE MANAGER

QUEENSLAND TRANSPORT

TOOWOOMBA CHRONICLE 25/8/95

To the Editor

Centenary of a bridge

The Maryborough Wide Bay & Burnett Historical Society is planning to celebrate the centenary of the Lamington Bridge, Maryborough, on Saturday, October 26, 1996. This important low-level bridge on the Bruce Highway crosses the Mary River and links southern areas of Queensland to the City of Maryborough.

It replaced the wooden high-structured bridge which was destroyed in the devastating 1893 floods.

The Lamington Bridge is a historically important structure believed to be the first reinforced concrete bridge built in Australia. Its 11 spans are reinforced with railway rails to both the top and bottom faces of the deck. The 11 spans of the superstructure were placed in only 22 days — a half-width of each span being placed every day. It was officially opened on October 30, 1896.

A book is being published for the occasion and we would like to make contact with all descendants of those who worked on the construction of the bridge or were members of the Maryborough Bridge Board. Any memorabilia of the occasion would be appreciated for displays.

Celebrations are planned for Saturday, October 26, at the Aquatic Centre near the bridge.

A dinner will be held that evening in the Maryborough Town Hall. Everyone is welcome to help us celebrate.

Inquiries: The Secretary, MWB&B History Society, PO Box 84 Maryborough Qld 4650. — **JACKIE TEMPLETON, hon secretary**